ENTOMOLOGY IN INDIA

"A king of France, when travelling in Catalonia, discovered an ancient man engaged unremittingly in the planting of date kernels. 'Why,' he asked, 'do you sow the seeds of a tree of such tardy growth, seeing that the dates will not ripen till a hundred years be passed?' 'Am I not then,' replied the other, 'eating the fruit of trees planted by my forefathers who took thought for those who were to come? Why, therefore, should I not do like unto them?"—*Travels of the Bohemian Lev. Lord Rozmital and Blatna, in Western Europe* (1465-1467).

The insects of India have attracted the attention of the learned from very early times. I have not the linguistic attainments to discuss the mention of various insects in ancient Sanskrit works. Suffice to say that insects such as the *pipîlikâs* or ants and the *matachî*, a devastator of crops in ancient India, which has been identified by Dr. Bhandarkar as a locust, is mentioned in Sanskrit works written several hundred years before Christ, such as the Vedas. Indeed, as Dr. Brajendranath Seal has shown in his *Positive Sciences of the Ancient Hindus*, long before the time of Alexander and Aristotle the Sanskrit authors had the elements of a classification of animals and plants. The physician Susruta and those before him based their classification on the mode of reproduction, and I think this held good till the time of Umâsvati, who in the Jaina work *Tattvâthâdhigma* (*circa* 40 A.D.) proposed a classification by series, the number of senses possessed by the animal being taken to determine its place in the series. The Vertebrates, however, were subdivided according to the manner in which reproduction takes place. Anyone who reads Dr. Seal's account of Umâsvati's classification will be struck with the resemblance of its divisions to that of a modern zoological classification.

The Greeks and the Romans have also had something to say of Indian insects. Ktêsias the Knîdian, the first writer to give the Greeks a treatise on India, writing

about 400 B.C. speaks of trees covered with amber (electron) and remarks that insects are found with it that yield a red-dye. This electron or amber of Ktêsias was certainly shellac and the insects associated with it lac-insects. Pliny mentions this and so does Aelian, who also writes of an insect called the *dikairon*, to the dung of which he attributes the properties of an opiate and a poison. This has been identified by Dr. V. Ball as the dung-beetle.

The ancients sometimes wrote of phenomena caused by insects without knowing it. For instance, Aelian says that "in India, and more especially in the country of the Prasians (the people of northern Bengal and of Bihar) liquid honey falls like rain upon the herbage and the leaves of marsh-reeds, and supplies sheep and oxen with an admirable kind of nutriment, the exceeding sweetness of which the animals highly relish. Now the herdsmen drive them to those spots where this delicious dew falls and lies, and the cattle in return supply the herdsmen with a delicious repast, for they yield a very sweet milk which does not require honey to be mixed with it as is done in Greece." Polyainos also speaks of cakes placed on the table of the king of Persia made of 'honey that fell in rain' and Nonnos says that in Arigantia of India a dew of honey lies on the leaves of trees in the morning. This aërial honey, as the Greeks call it, was probably the same as the manna with which the Israelites were fed in the wilderness. Manna has been thought by some to be a lichen and by others a vegetable secretion, but is now generally considered to be the secretion of a scale-insect. Ealand in his *Insects and Man* tells us that "an Englishman, Hardwick, while travelling in Persia, discovered the insect, which he called *Chermes mannifer*; and, a little later, Ehrenberg found the insects on tamarisk, growing near Mount Sinai and at the same time saw their secretion, which closely resembled honey in appearance, and was known to the Arabs as 'man'. According to the latter authority, the manna insects.

which are now known to science as *Gossyparia mannifera*, infested the smaller branches of *Tamarix gallica* in large numbers, sucked up sap in quantity, and exuded manna in the form of a sugary secretion which in the cool of the evening, fell to the ground in solid form, but, after sunrise, melted and percolated into the soil." Little is known about this insect and nowadays the secretion is not sufficiently abundant to make it of any commercial value

The writings on insects of the ancients are sometimes wonderfully accurate, but are often the result of mere superstition, as those who have read Virgil's *Georgics*, to mention only a single work, know. I may quote as an example of their superstition the famous story of Megasthenes and Herodotus of the gold-digging ants of India which have been identified with Thibetan gold miners, and it may be added, their dogs! The Hindus, the Greeks and the Romans may have laid the foundation of Zoology and its immense branch, entomology, but to-day their records have little more than an historical interest and we need not consider them further here. Let us proceed to work done in India in more recent times.

Early in the seventeenth century, when entomology was just beginning to develop in Europe, Robert Knox, his father and fourteen others were captured off the coast of Madras and taken to Kandy in Ceylon, which was at that time under Singha II. During his captivity Knox learnt much of the characteristics of the country, and when after twenty years he managed to effect his escape, he published in 1681 his *Historical Relation of the Island of Ceylon in the East Indies*. In this work "the Beasts, Tame and Wild, and Insects" are discussed in the sixth chapter, and many careful observations on the ants and "white-ants" and the honey-bees are recorded.

About the middle of the nineteenth century that the entomologist Nietner did valuable work in Ceylon, but it was not until several years later that any monographic work of real merit was achieved. The publication of Frederick

Moore's great work *The Lepidoptera of Ceylon* between the years 1880 and 1887, and E. E. Green's *Coccidae of Ceylon*, the first part of which appeared in 1896, marked an epoch in the entomological history of Ceylon. In 1904, the serial *Spolia Zeylanica*, started by the Colombo Museum was first published and has continued to flourish and is now recognised as one of the most important natural history journals in the East. It contains many papers of entomological importance.

In India the first work done was in the South. James Anderson, who was appointed Physician-General of Madras in 1786, carried out some experiments on indigenous "Cochineal" insects, and the botanist J. G. Koenig, a friend of Anderson and a pupil of the great Linnaeus, wrote a paper on termites which Mr. T. Bainbrigge—Fletcher has recently reproduced in the *Report of the Proceedings of the Fourth Entomological Meeting*, Pusa, 1921, with a short biography of the author. It is probable that Koenig collected the large series of insects from Tranquebar which J. C. Fabricius described. In the latter half of the eighteenth century hundreds of insects, principally from South India, were described by Linnaeus, Fabricius, Cramer, Drury and others.

It was not until 1800, however, that the first monographic work appeared. This was E. Donovan's *Natural History of the Insects of India*, a revised edition of which, edited by J. O. Westwood, appeared in 1842. Westwood, however, maintained that many of the insects described therein belonged to the East Indies rather than to India and some even to the West Indies.

Forty years after the first publication of Donovan's work the Rev. F. W. Hope published in the *Madras Journal of Literature and Science*, XII, pp. 105-12[1], a paper entitled "On the Entomology of the Himalayas and of India" with descriptions of insects by J. O. Westwood on pp. 129-136. In 1842 Hope also read to the Linnaean Society two papers on rare and beautiful insects from Sylhet.

Donovan's work and Westwood's *Cabinet of Oriental Entomology* gave a great impetus to the study of insects in India, and the coming of men like Wood-Mason, Marshall, De Nicéville, Bingham, Swinhoe, Moore and the inimitable Aitken in the latter part of the nineteenth century established the future success of entomology in this country.

J. Wood-Mason was Superintendent of the Natural History Section of the Indian Museum from 1869 to 1893, during which period he contributed to nearly every branch of zoology. His most important contributions to entomology were on the cockroaches, soothsayers, stick-insects, leaf-insects and on the butterflies, wherein he had the able co-operation of Mr. Lionel De Nicéville. His papers on the Mantidae were mainly contributed to the *Annals and Magazine of Natural History* and to the *Journal of the Asiatic Society of Bengal*, at that time perhaps the only medium for the publication of zoological papers in India. Wood-Mason and De Nicéville's series of papers on the butterflies of the Andamans, the Nicobars and of Cachar also appeared in this Journal. It was unfortunate for Indian entomology that Wood-Mason never lived to complete his *Catalogue of the Mantoidea in the Indian Museum*, a part of which was published by the Trustees in 1889.

The work which established the fame of De Nicéville is known to every lepidopterist as *The Butterflies of India, Burmah and Ceylon*, the first volume of which was written in collaboration with Major G. F. L. Marshall, known to ornithologists as the part author of a monograph on barbets. Both De Nicéville and Marshall contributed many papers to the Asiatic Society's Journal and to the *Journal of the Bombay Natural History Society* and to European publications.

The Bombay Natural History Society was founded in 1883 by eight residents of Bombay. In 1886 they issued the

first number of their Journal, the object being to "stimulate lovers of Nature ..... to record and communicate their observations." This Journal is recognised to-day as the best periodical in India for the publication of short notes on Natural History, and for papers both scientific and popular on subjects likely to interest the amateur naturalist or sportsman. Even to those who are professional scientists it is of great value. In the past, as in the present, the society included amongst its members some of the most famous scientists in India. E. H. Aitken ("EHA"), known to many as the author of *Behind the Bungalow*, *The Tribes on my Frontier*, and *A Naturalist on the Prowl*, was the joint editor of the first few numbers and one of the most constant contributors to the Society's Journal.

The *Indian Museum Notes* was started in 1889 as "Notes on Indian Insect Pests" under the editorship of E. C. Cotes and continued till 1903, the last volume being edited by De Nicéville. This journal contains many notes and articles of importance to entomologists, especially to those working on the economic aspect of the subject. Some of the most famous scientists in Europe contributed to the publication, while of Indian contributors I may mention E. E. Green, L. De Nicéville, C. T. Bingham, F. Swinhoe, G. C. Dudgeon, F. Moore, S. Barlow, S. E. Peal, E. T. Atkinson, Cotes himself and others. A monument to Mr. E. T. Atkinson's memory are his catalogues of various families of Indian beetles and bugs, while Cotes and Swinhoe's *Catalogue of Moths* though out of date is no less deserving of praise. Col. Bingham was for many years resident in Burma and a very keen and competent entomologist. As one who has done a little work on the Aculeate Hymenoptera and the butterflies I know the value of his volumes on these groups in the "Fauna of British India" series.

With the mention of Mr. W. L. Distant's fine *Monograph of the Oriental Cicadidae* published between 1889 and 1892

by the Trustees of the Indian Museum I will pass on to a brief consideration of the work done in the last two decades. So much has been accomplished that it is quite impossible in the space at my disposal to attempt more than a short general account in which details will necessarily have to be omitted.

Calcutta—in spite of attempts of remove the Museum to Delhi—is one of the centres of zoological and entomological research in India, and it owes its position in no small measure to Lt. Col. A. W. Alcock, the former Superintendent of the Natural History Section of the Indian Museum and to Dr. N. Annandale, the present Director of the Zoological Survey of India. Prof. E. P. Stebbing, who has contributed much to entomology, especially those aspects of it which relate to forestry, was working in the Indian Museum for a short period and many papers appeared from his pen at this time. He is the author of a popular book entitled *Insect Intruders in Indian Homes* which every Indian naturalist should try to read, and of a text-book on Forest Insects. The late Mr. Peal and Mr. Barlow, who would have made a name for themselves were it not for their untimely death, also worked in the Museum early in the first decade of the present century.

The late Mr. C. A. Paiva joined the Indian Museum as a gallery assistant in 1899 and was no doubt much encouraged in his entomological studies by these gentlemen and by Col. Alcock and Prof. Maxwell-Lefroy. Under Lefroy he received entomological training at Pusa and was appointed special entomological assistant in 1904. In 1905 he wrote his first paper under the guidance of Dr. Annandale. This was published in the *Journal of the Asiatic Society of Bengal* and since then, till his death in 1919, he contributed many important papers to the Asiatic Society's publications and to the *Records of the Indian Museum*. Dr. Annandale himself has published many notes and papers on insects and between 1907 and 1911 wrote many valuable systematic papers on the Psychodidae, a family of two-winged

flies (Diptera), which were published in the Asiatic Society's Journal, *Spolia Zeylanica* and the *Records of the Indian Museum*. Mr. E. Brunetti came to India in 1906 and two years later published his first paper on Indian Diptera in the Indian Museum Records. He is now one of the greatest living authorities on Indian Diptera and his success is in no small measure due to Dr. Annandale.

A lasting tribute to Dr. Annandale's energy is the founding of the Records and Memoirs of the Indian Museum in 1907. From its inauguration to the present day the Records contain many valuable papers and notes on Indian insects, while such important monographs as Dr. F. H. Gravely's "An Account of the Oriental Passalidæ" and his "Contribution towards the Revision of the Passalidæ of the World," Dr. J. J. Kieffer's "Etude sur les Chironomides des Indes orientales," Prof. M. Bezzi's "Indian Trypaneids in the collection of the Indian Museum, Calcutta" and the late Mr. Basbambar Das' "Aphididæ of Lahore," have been published in the Memoirs. Dr. Gravely, now Superintendent of the Madras Museum, is well-known as an authority on certain groups of beetles and beetle-larvæ and is now devoting his energies to a study of the spiders.

On the mosquitos we have had many workers. Among the best known are Major S. R. Christophers, Lt. Col. Glen Liston and Major S. P. James. Dr. Baini Prashad of the Zoological Survey of India worked on mosquitos for some time and was making a reputation as an authority on the anatomy of aquatic Diptera, but because of his more extensive malacological studies he has more or less discontinued this work.

At present, so far at least as economic entomology is concerned, Calcutta has had to yield her laurels to Pusa, where the entomological section of the Agricultural Institute is situated. The work of the entomologists employed there has saved the Government millions of rupees and their publications are of interest to both the systematic and the economic

entomologist and to those interested in the life histories and habits of insects.

The first Imperial Entomologist was Prof. Maxwell-Lefroy, who is now Professor of Entomology in the Imperial College of Science and Technology at London. Prof. Lefroy is known to every Indian naturalist as the senior author of *Indian Insect Life*, in which he had the able collaboration of the late Mr. F. M. Howlett, who wrote the sections on Diptera and Lice and also drew many of the illustrations. Howlett was perhaps the only entomologist in India who did work of importance on what may be called the Psychology of Insects.

The indefatigable energy of Mr. T. Bainbrigge-Fletcher, the present Imperial Entomologist is known to most students of insects, and every recent entomologist in India has had at one time or another to seek his aid, which has always been given in a most generous spirit. It was Mr. Fletcher who inaugurated in 1915 the biennial entomological meetings held at Pusa and which have resulted in undeniable success. The Proceedings of these meetings have so far been published in five volumes and contain valuable papers by almost every entomologist in India on all aspects of the subject. Mr. Fletcher's numerous contributions to entomology are known to all entomologists, and not only entomologists, but also amateur "bug-hunters" are familiar with his *Some South Indian Insects*, the introductory chapters of which are written in a most readable style. Prof. Lefroy's and Mr. Fletcher's books should alone convey to the lay mind the importance of the work that can be done by two men only working amidst Indian difficulties.

There are five other important centres of entomology in India. These are: the Forest Research Institute at Dehra Dun, where entomological work is carried out under the leadership of Mr. C. F. C. Beeson, the Agricultural College at Coimbatore where the Government Entomologist and his very capable staff work, the Agricultural Colleges at

Lyallpur and Cawnpur, and the Institute at Kasauli where research, especially on mosquitos, is carried out under the guidance of Major S. R. Christophers, himself one of the most famous of Culicidologists.

Space does not permit me to do more than mention *en passant* the work done by more or less isolated workers in the different provinces in India, or the voluntary work done by such men as Major F. C. Fraser on the Dragonflies and their allies and Lt.-Col. W. H. Evans on the butterflies. We must also not omit to pay a tribute to those workers who have helped India, both in the past and in the present, from abroad.

In this review I have not attempted a *resumé* of the literature on Indian entomology—such an attempt would fill a volume—but merely to indicate briefly the work done by entomologists in this country, who it must be remembered work under a variety of difficulties. Like Magda, Queen of Sheba, whose devotion to Learning made her set out for Jerusalem, the capital of the kingdom of Solomon, they have entered the domain of Science not with the object of any financial benefit to themselves but for their love of Knowledge. They have worked in the interests of Science alone, yet certain branches of their work has saved India millions of rupees, while others have added large sums to her coffers. Is it not then up to the Government to improve the status of entomology in this country and to make it a more lucrative profession? Even its most devoted votaries are apt to forget *les douces joies de la science* when 'the stomach pinches,' as the Indians say.

Every educated man to-day knows the importance of the study of mosquitos, but few realise that about one million people die annually of malaria—a disease carried entirely by mosquitos—to which we have to add the loss to the wage-earning capacity of people suffering from the disease. Estimating the money value of each life at the insignificant sum of Rs. 100, we find that the State loses from this disease alone about ten crores of rupees. It is more than probable,

as Sir Ronald Ross said in a lecture on malaria in Greece, delivered to the Oxford Medical Society in November, 1906, that "Causes such as malaria, dysentery, and intestinal entozoa must have modified history to a much greater extent than we conceive." And it is almost certain that "our historians and economists do not seem even to have considered the matter. It is true they speak of epidemic diseases, but the endemic diseases are really those of greatest importance....."

The damage done by pests of crops, forest trees, structural timber (the losses to railway sleepers by termites alone run into crores), stored products, clothing, etc., almost sets calculation at defiance, and as Curtis said in his *Farm Insects* more than fifty years ago, "....if an approximation could be made to the quantity thus destroyed, the world would remain sceptical of the results obtained, considering it to be too marvellous to be received as truth." Yet, as Mr. Fletcher has remarked, there is in general a sort of *cui bono?* attitude towards entomology, probably founded on the fact that insects are small animals and are therefore considered to be of little consequence. Few realise "the real importance of the study of entomology in a country such as India, where seven-tenths of the people depend directly for their livelihood on the produce of their fields, which produce is ravaged by insect-pests both before and after harvest and where such a vast aggregate toll is taken by insect-borne diseases both amongst man and his domestic animals."

Mr. Fletcher has tried to calculate the average annual losses to India through the ravages of insects and finds that the losses due to—

Crop-Pests.....amount to...	Rs.	1,80,00,00,000.
Forest-Pests.....	Rs.	1,25,00,000.
Human Diseases.....	Rs.	16,00,00,000.
Animal Diseases.....	Rs.	3,82,36,000.
Total.....	Rs.	2,01,07,36,000.

This huge annual loss to India of over two hundred crores of rupees will no doubt have the effect imagined by Curtis, but it is no exaggeration, and should indicate to the Government the immediate necessity of more entomologists. "If we, by a study of insects and by practical application of the knowledge gained thereby, can save even one per cent. of this enormous wastage of the national wealth of India such a saving would more than justify the most complete expansion of entomological work that we can possibly imagine."

Not only is it to wage war against insects that we require entomologists, for if by a study of beneficial insects such as the silk-moths and the lac-insect we can control or increase their produce, the revenue of India would be considerably enriched. And there is no doubt that researches on such insects performed by suitable men under suitable conditions will have this result.

I have striven to show above the importance of entomology and that in spite of difficulties India and Ceylon have in no small measure added to the stores of entomological learning, but this does not mean that the position of entomology in this country to-day is at all satisfactory. It is not. For instance, what is perhaps the largest and certainly the most valuable collection of insects in India—I refer of course to the entomological section of the Zoological Survey of India—has not a qualified Staff to look after it and to do serious research on the large collections of unnamed material which have accumulated. All that can occasionally be done is work on small collections of special interest. There is I think not even a numerical sufficiency of subordinate staff to pay adequate attention to the care of the collections.

The industrialist has apparently already recognised the value of science (as was shown by Sir Rajendranath Mukherjee's Presidential address to the Science Congress at Calcutta last year), but he has so far been enjoying the fruits of scientific labour with little or no financial help on his part.

"If India (said Sir Rajendranath) is to advance commercially and also economically, she must spend money on scientific investigation." This the Indian Government is apparently not prepared to do at present to the extent required by our needs. So "it is part of the duty of all commercial and industrial concerns which benefit directly or indirectly, from scientific research, to set aside a portion of their enhanced profits for the purpose of contributing to scientific associations .....to enable its members to extend their work and devote more time to further discoveries."

But it appears that there is a feeling among scientific men in India that, as Dr. Annandale wrote in his "Ethics of Zoology" in the March number of this journal, "private donations to science often do more harm than good, not only because of the conditions which usually hedge them round, but also because they weaken individual effort in research." This may be in some measure true, but if we are beggars we cannot be choosers. In my opinion a donation made by a sane man for the purpose of carrying out some particular research or researches is not likely to have any very unreasonable conditions attached to it. The American institutions benefit largely by private donations and I think the value of the work done by their members proves my point. I believe, moreover, that a donation which would enable a conscientious man to extend his researches would increase rather than decrease his efforts in the cause of Science. It is idealistic but unpracticable to say that Science abhors patronage and flourishes in hardship and opposition, for nothing can flourish when sufficiently strongly and continually opposed. Anyway, we have not yet had the opportunity to test the accuracy of this statement, for though Science in India has been, and is still, sadly neglected, it has not been viewed with an unsympathetic eye.

If we in India are to make further scientific discoveries of value, there must be more co-operation: co-operation between

the various scientific departments and co-operation between the industrialist and the scientist. The general public must also be made to realise that the scientist, and in this article I refer especially to the entomologist, is not a harmless imbecile who by some strange dispensation of Providence has been allowed to pursue his hobby at Government expense.

> "By mutual confidence and mutual aid,
> Great deeds are done and great discoveries made."

I will close this article with a story narrated by a famous American professor as a parable for Indian entomologists.

"It is related that a couple of habitual and impecunious pedestrians, sitting on the roadside engaged in conversation as follows:—

'I wish I had a million dollars.'

'Suppose you had, would you give me a thousand.'

'No.'

'Would you give me a hundred.'

'No.'

'Well, would'nt you give me even a dollar.'

"No. I would'nt give a cent to a man too— —lazy to wish for himself !"

The moral is obvious.

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